

Problem Set 3 - R - Exercises

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Additional Plots for problem 1

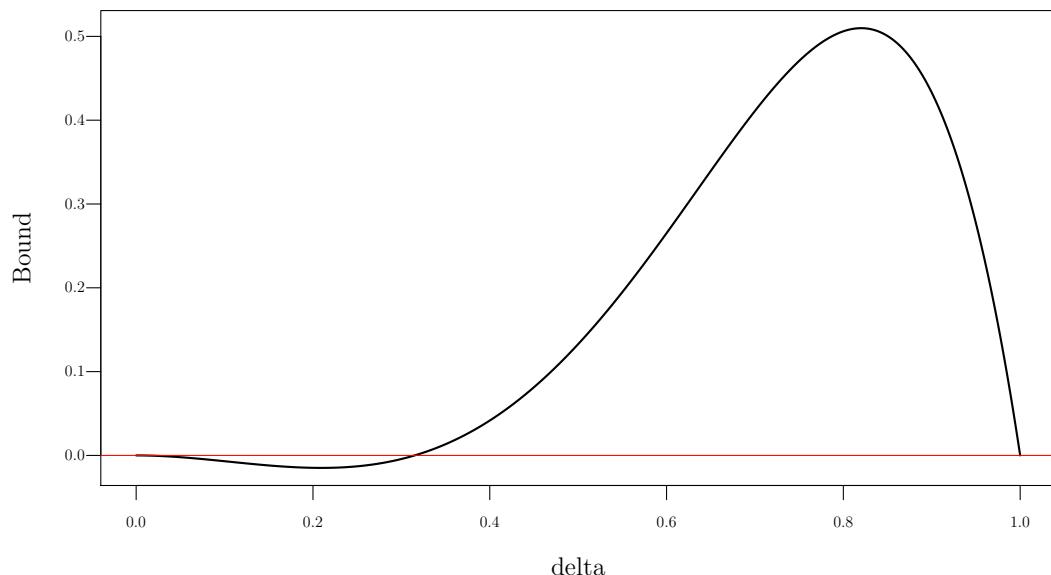


Figure 1: For Which Values of Delta the Bound is Positive

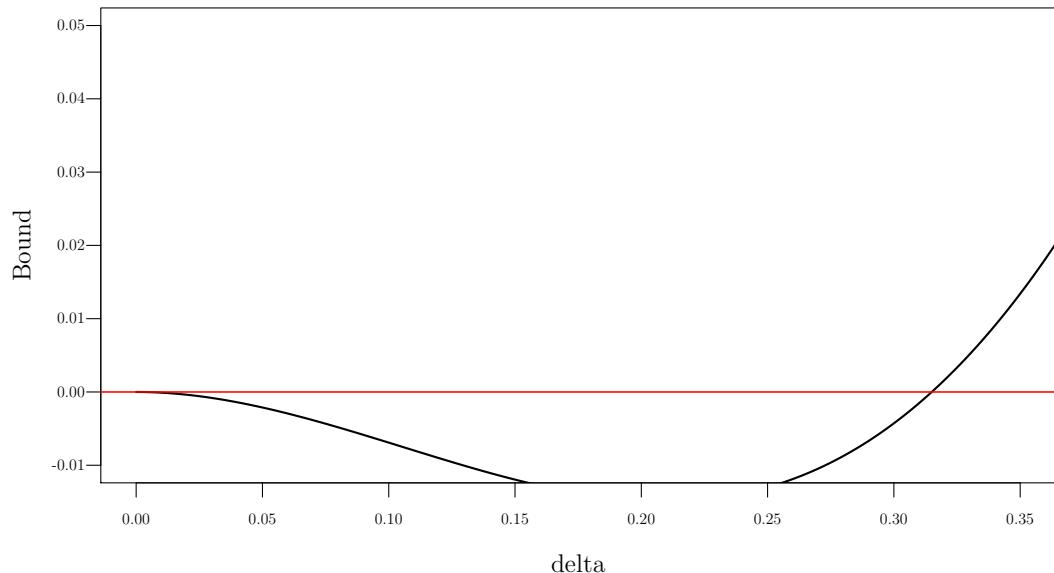


Figure 2: Higher Resolution to Identify the Delta

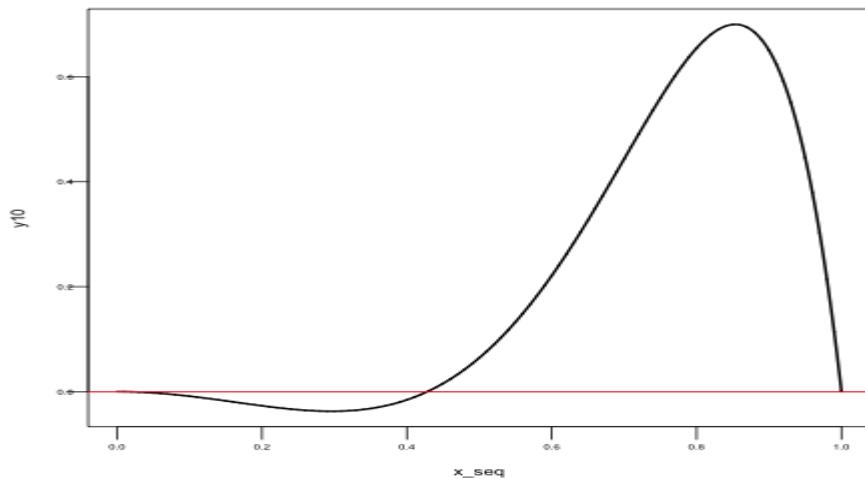


Figure 3: 10-Node Case

Exercise 5.1 Barabasi

(a) & (b)

Figure 4 (a) shows the degree distribution for intermediate steps and figure 4 (b) the log log plot. We can observe convergence.

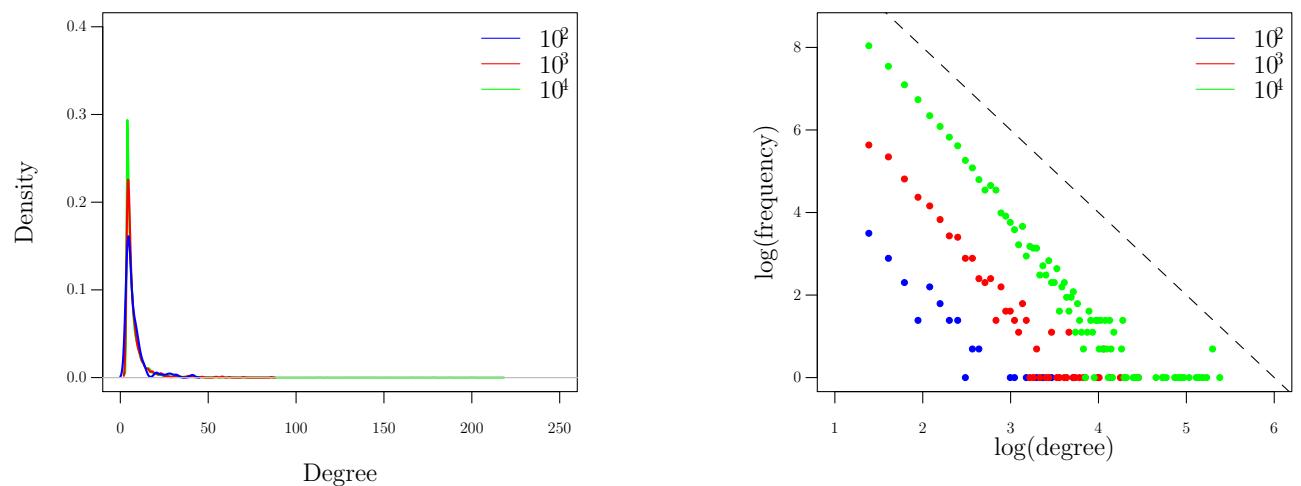
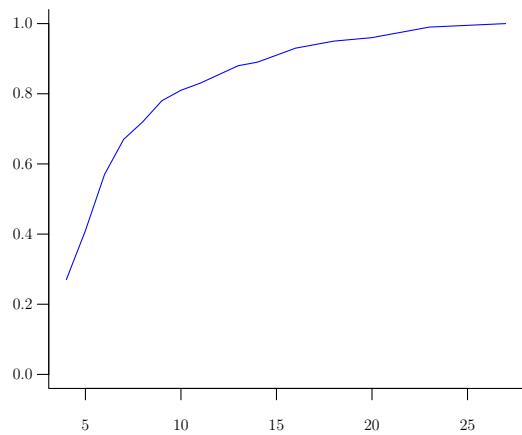
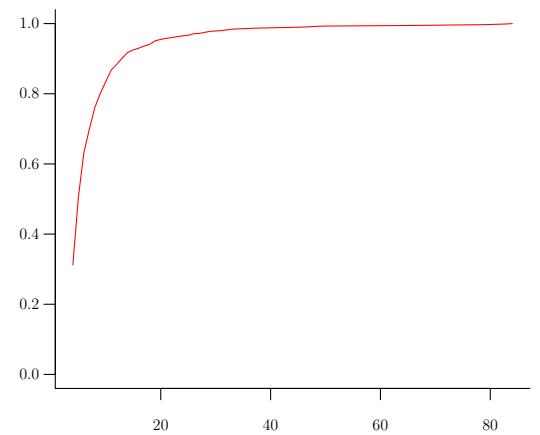


Figure 4: Degree Distribution

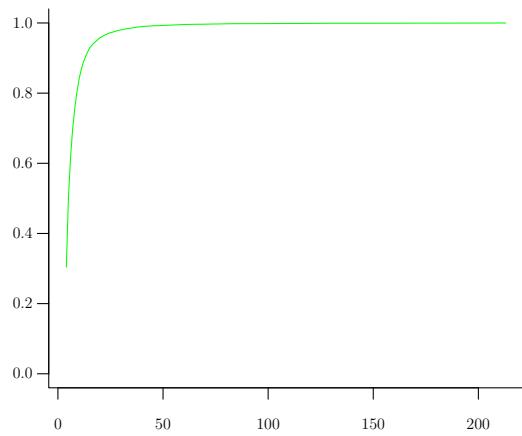
(c)



(a) CDF for 10^2 nodes



(b) CDF for 10^3 nodes



(c) CDF for 10^4 nodes

Figure 5: Cumulative distribution function

(d)

Average Clustering Coefficient	
10^2	0.133
10^4	0.03
10^6	0.004

Table 1: Average clustering coefficient for intermediate steps

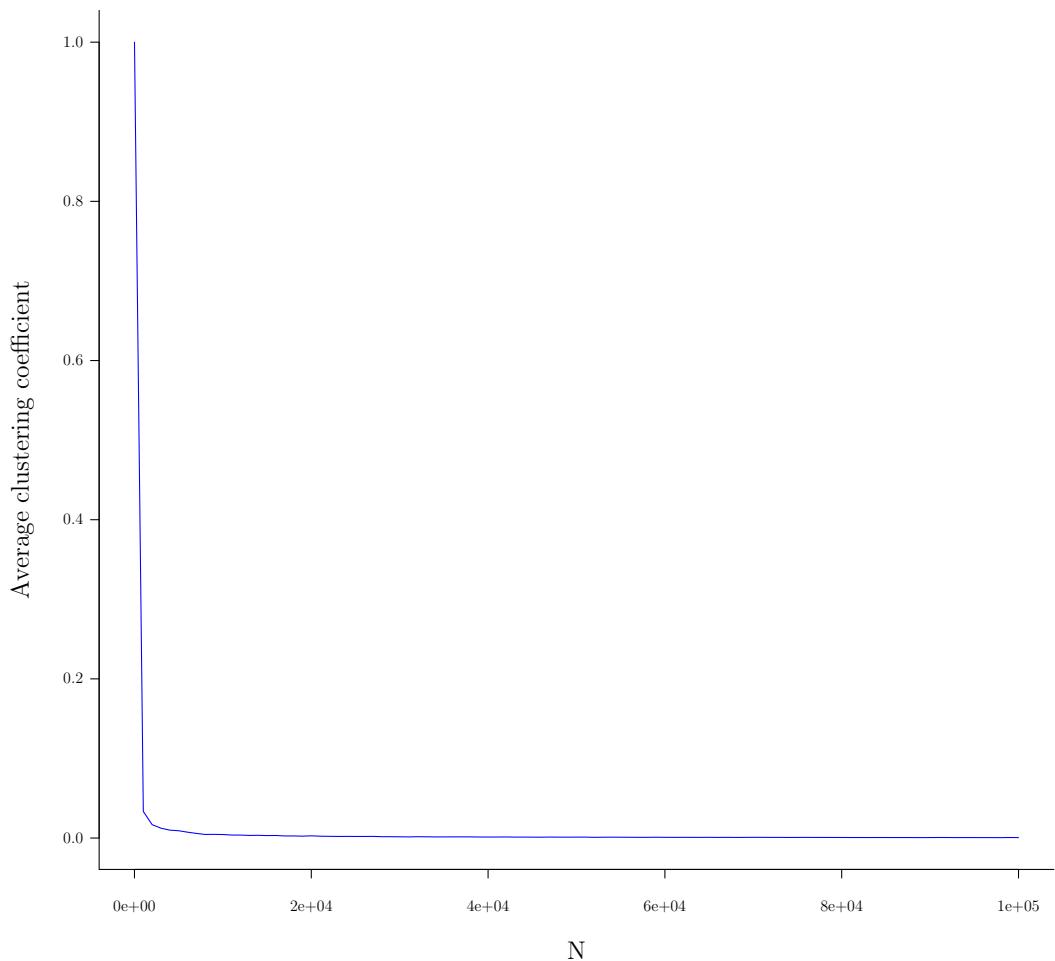


Figure 6: Average clustering coefficient as a function of N

(e)

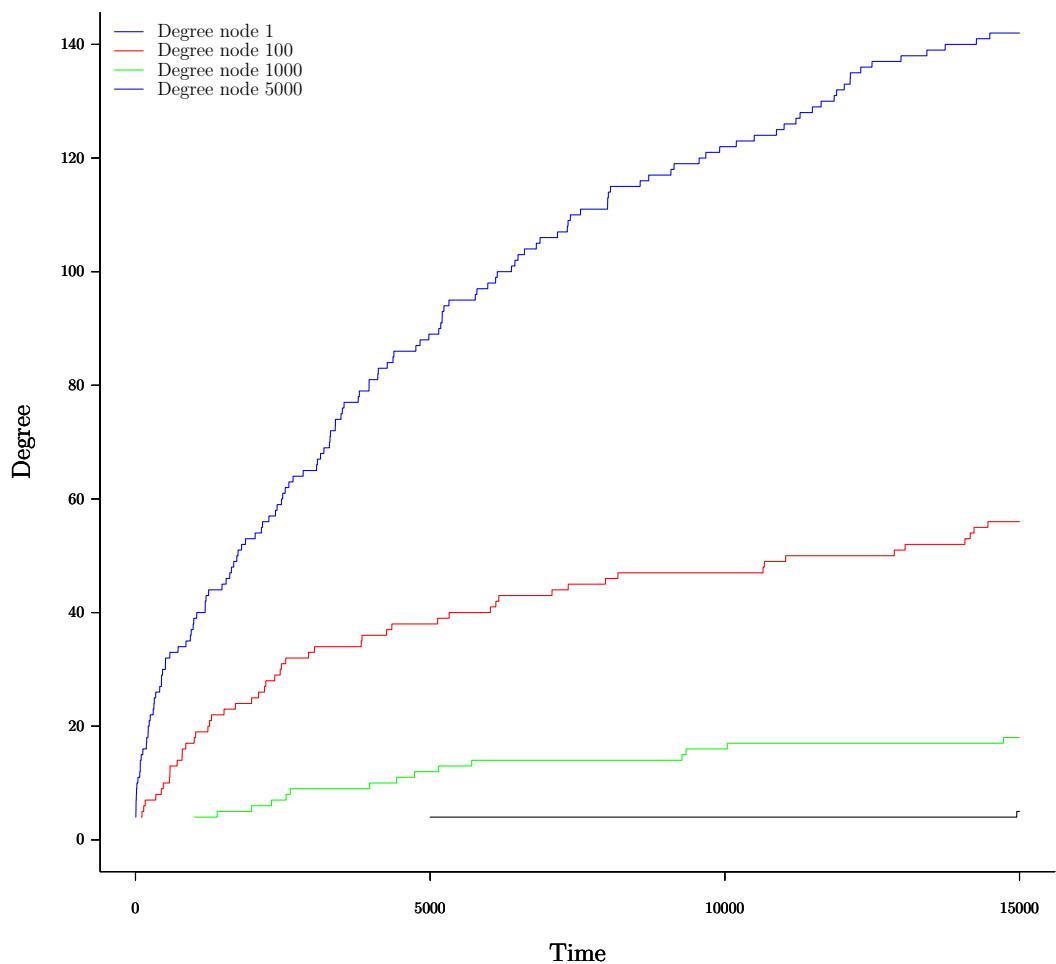


Figure 7: Degree dynamics

1 Exercise 2

(1) - (5)

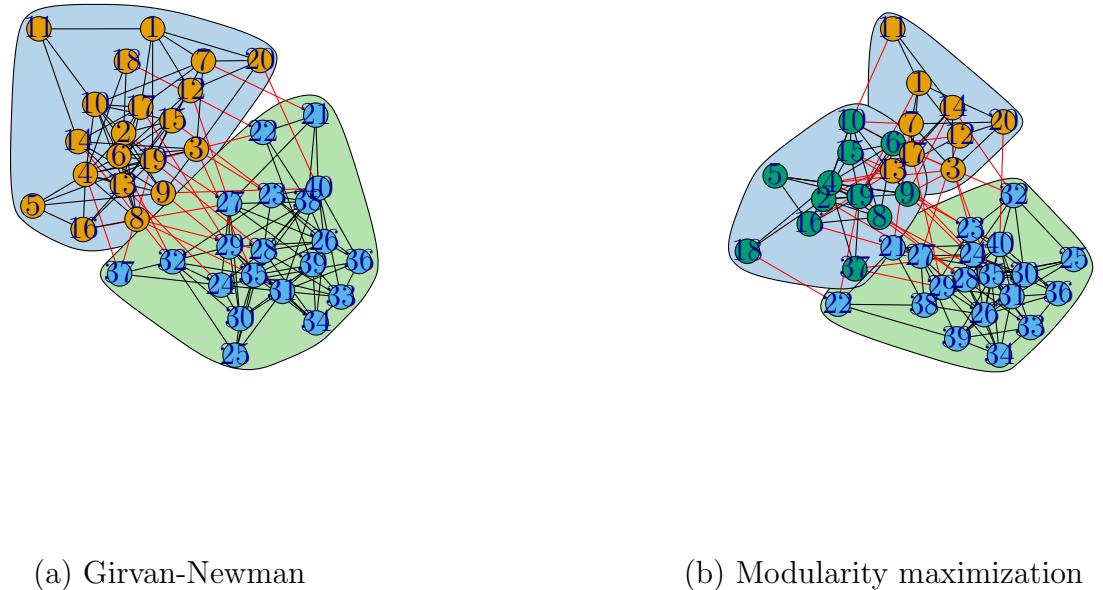


Figure 8: Communities with different algorithms

Figure 8 shows the results for both community detection algorithms.

The Girvan-Newman algorithm is based on edge betweenness. In every iteration the edge betweenness is calculated and nodes with high values are removed. In doing this sequentially components are isolated and the community structure is found.

Modularity optimization has a more "statistical approach". It identifies communities based on the true number of edges and the expected number one would see in a random process. Hence, the graph is split by optimizing for large modularity.

(1) - (6)

The following figure shows the dendrogram for the Girvan-Newman method. Modularity maximization does not follow hierarchical procedure, which implies that there is no dendrogram.

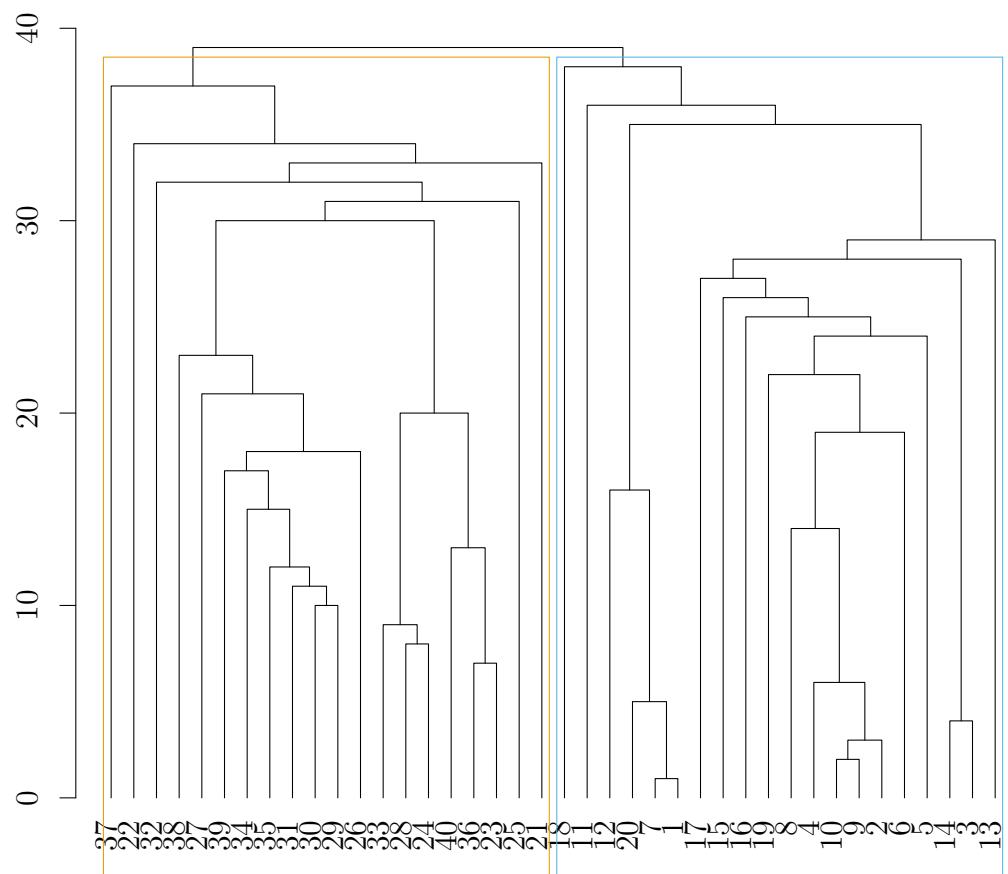


Figure 9: Dendrogram Girvan-Newman method for community detection